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(54) Title: METHOD AND SYSTEM FOR STORING A CODING PATTERN
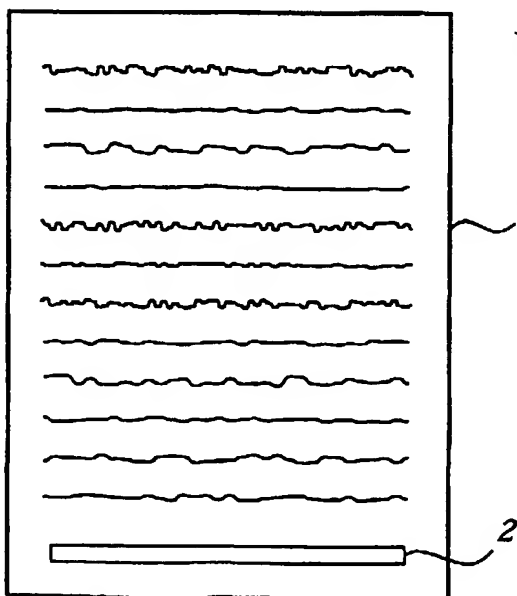
(57) Abstract: A product (1) with stored non-sequential
data is provided by means of a method which comprises
the step of coding the data (6, 52) to a coding pattern (2) by
means of at least one sequence (32) with symbols (3, 24)
which have the characteristic that an arbitrary subsequence
of a predetermined magnitude of the sequence (32)
unambiguously defines the position of the subsequence (34,
35) in the sequence. Then the coding pattern is reproduced
on a product (1). A user unit is adapted to record and decode
the coding pattern (2).

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METHOD AND SYSTEM FOR STORING A CODING PATTERN

Field of the Invention

The present invention relates to a method for storage of information or data and a device adapted to read data stored by means of the method.

5 ## Background Art

There are a plurality of known methods for storage of data. The traditional technique of storing written information is to store text in printed products such as books and newspapers. There are, however, several draw-
10 backs of storing text in book form. One of the drawbacks is that books require much space. To achieve storage requiring less space, documents have for a long time been stored on microfiche. For a high degree of compaction, it is, however, necessary to use photographic films for
15 such storage since ordinary paper has a strictly limited packing density. The storage alternatives to books which are advancing most rapidly are those based on the use of computers. A plurality of storage media for digital information are available. Examples of such storage media
20 are RAM, magnetic media and optical media, such as optical discs. Another technique of storing information that can be read optically is bar codes which are used to a great extent in the retailing of everyday commodities when prices are included.
25 It is in some cases desirable to distribute text stored in a compact fashion. A drawback of using computers in such cases is that the user must then be electronically connected with the distributor of the stored information. An alternative is distributing
30 microfiche or magnetic or optical data storage media containing the information that is to be distributed. However, it is relatively expensive to distribute data storage media or microfiche to a large group of people.

There is thus a need for an alternative method for compact storage of data and an alternative device for recording data stored by means of the method.

Summary of the Invention

5   An object of the present invention is to provide a method for compact storage of non-sequential data.

A further object of the present invention is to provide a method for compact storage of written text which allows easy distribution to a plurality of users without
10   using electronic transmission.

One more object of the present invention is to provide a method for storage of a command which controls a computer.

Another object of the present invention is to pro-
15   vide a device for recording of information which has been stored by means of the method according to the present invention.

These and other objects are achieved by a method, a device and use according to the appended claims.

20   A basic idea of the present invention is to store text and other data by means of a matrix with symbols, which matrix can be recorded optically.

A method for storage of non-sequential data according to the invention is characterised in that it com-
25   prises the steps of coding the data to a coding pattern by means of at least one sequence with symbols which have the characteristic that an arbitrary subsequence of a predetermined magnitude of the sequence unambiguously defines the position of the subsequence in the sequence,
30   and reproducing the coding pattern on a product.

In this context, the term "product" relates to all possible articles on which a coding pattern can be applied. In the first place, sheets of paper in news-papers, books as well as loose sheets of paper are
35   intended, but also other articles, such as bulletin boards, can be provided with a coding pattern.

Data relates to information such as text or other information. Data also relates to, for example, a command to a computer. This type of information is usually non-periodic.

The term non-sequential defines that the data is arbitrary in the sense that it is not a sequence of numbers in one or more dimensions. Such a sequence may easily be stored as a mathematical expression.

The product can be an arbitrary product on which one wants to have coded information. By coding the information by means of a sequence of the above type a code is made possible, which is relatively insensitive to how it is read by a user unit. At the same time, compact storage of the information is permitted. As mentioned above, the document may consist of any document whatever.

According to a preferred embodiment, the matrix is reproduced on a page in a book, the string of text being the text on the page of the book. It will thus be possible for a user to optically record the contents of the entire page of the book by recording the matrix with symbols.

Preferably, the data is converted into a set of data values, the pattern being arranged in such manner that it comprises portions of said at lest one sequence in a coding pattern, said portions being of at least the same magnitude as the subsequences of a predetermined magnitude, so that each of the data values codes a group each of at least two sequence portions in the coding pattern.

By coding the data in such manner that groups of at least two sequence portions are required for each data value, the coding pattern will be such that an arbitrary part of one sequence portion and the corresponding part of another sequence portion define a data value.

The data is advantageously coded with only one sequence so that the position of the subsequence in the sequence constitutes a sequence value and the relation-

ship between sequence values from different sequence por-
tions defines the data values.

By using only one sequence, the coding and the
recording of the coding pattern are simplified to a con-
siderable extent. A user unit which is used to read the
coding pattern can then process all parts of the coding
pattern in the same way. It is also advantageous that
only two sequence portions are required to code a data
value since the coding pattern can then be made more com-
pact.

Advantageously, each of the data values is defined
by the difference between the sequence values for two
subsequences from different sequence portions. Although
some other relationship between the sequence values can
be used, it is advantageous to use the difference between
the sequence values since it simplifies the method when
reading the coding pattern.

According to another embodiment each of the data
values is defined by a single sequence value. According
to this embodiment the subsequences are arranged in a
pattern so that the subsequences are arranged separated
from each other. Preferably, the subsequences are arran-
ged in a row so that the symbols of the subsequences may
be recorded in a single stroke with a reading pen.

The sequence portions are preferably juxtaposed in
a matrix so that each of the data values is defined by
the difference between the sequence values for two
adjoining subsequences from corresponding parts of the
sequence portions in the matrix. As a result, a user unit
can easily convert the matrix and its subsequences with
symbols into subsequences with values. It is possible for
a user unit to convert the subsequences with values into
data values. Since the data values are defined by dif-
ference values, the data values will be independent of
which parts of the sequence portions are recorded.

It is, of course, possible to arrange the sequence
portions in a way other than in a matrix. However, it

facilitates the recording of the sequence portions that
they are arranged in a matrix.

The sequence portions advantageously code also at
least part of a position value which defines the serial
number of the sequence portion. This means that it is
not necessary to record the entire coding pattern on the
same occasion since the order of the different parts can
be obtained from the position value. This facilitates
recording of the matrix since a user unit which records
the matrix can then decide whether sequence portions have
already been recorded previously. In the case of missing
certain sequences in connection with the recording when
a user unit is scanned across the coding pattern, it will
thus be possible to record the missed sequences on a
later occasion and place them in the correct position
by means of the position values. The position values
are also of assistance when checking that no sequence
has been missed.

Advantageously, part of a difference value defines
part of a position sequence, which is arranged in such
manner that an arbitrary position sequence part of a pre-
determined magnitude unambiguously defines the position
of the position sequence part in the position sequence.

In the case where the difference values do not
define position values, it is advantageous to reproduce
the coding pattern on the product together with a marking
which indicates a reading direction. Thus, it is ensured
that the coding pattern and, thus, the data are not
recorded in reverse order. If there is a position code,
it is not necessary to have such a marking. The marking
with the reading direction need be supplemented with the
putting together of images so as to guarantee that each
sequence is recorded only once.

Even if the data can be arbitrary data, it is pref-
erably characters which are converted into data values.
Alternatively, the data consists of, for example, a com-
mand to a computer.

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The conversion of the characters into data values can be carried out in several ways. Advantageously, the text is first compressed by means of some prior art compressing method so that the data that is to be coded is
5   minimised. Then each character in the coded data is converted into data values.

Preferably, the matrix is arranged in such manner as to comprise only columns with sequences which define sequence values. As a result, the matrix will be as
10   compact as possible. It goes without saying that it is possible to arrange the matrix so as to comprise also other information.

According to a less preferred embodiment, the matrix also comprises other sequences with symbols. These can
15   serve as delimitation between the sequences which define sequence values. However, the matrix will be less compact than in the case where the preferred embodiment is used.

On a product according to the invention data is stored in the form of a coding pattern which codes the
20   data. The product is characterised in that the coding pattern codes the data, the coding pattern consisting of sequence portions with symbols which each comprise at least a subsequence of a sequence which is arranged so that an arbitrary subsequence of a predetermined mag-
25   nitude of the sequence unambiguously defines the position of the subsequence in the sequence.

A product according to the invention codes data in a more compact manner than does a bar code since a product according to the invention can have information
30   stored in two dimensions.

Preferably, the coding pattern codes a set of data values, each of the data values being coded by a group each of sequence portions consisting of at least two sequence portions.

35   Consequently a code is permitted, which can be made independent of the reading in one dimension.

The symbols on a product according to the invention
can have many different kinds of appearance. According to
an embodiment, the symbols consist of markings, the size
of the markings defining the value of the symbol.

5   According to an alternative embodiment, each of the
symbols comprises a raster point and a marking, the value
of each symbol being indicated by the position of said
marking in relation to the raster point.

A user unit for optical recording of information
10   according to the present invention comprises an image
sensor and is adapted to optically record images from
a surface by means of the image sensor. The user unit
is characterised in that it is adapted, in response to
the fact that a recorded image comprises a predetermined
15   number of subsequences with symbols, each of the subse-
quences unambiguously corresponding to a position in a
predetermined sequence which is arranged in such manner
that an arbitrary subsequence of a predetermined magni-
tude unambiguously defines a position in the sequence,
20   to convert the predetermined number of subsequences into
data.

Preferably, the user unit also comprises a memory
intended for storage of data which corresponds to the
data value. Data stored in the memory can then be trans-
25   mitted to some other unit, such as a computer.

Instead of, or together with, a memory, the user
unit may comprise a display and can be adapted to show
on the display data which corresponds to the data value.

The user unit can be equipped with a loudspeaker via
30   which the user unit is adapted to transmit sound corre-
sponding to the data.

A user unit according to the invention is advanta-
geously adapted to convert the predetermined number of
subsequences into data values and to convert each data
35   value into only one character. This means that the memory
can be small since a reference table which is stored in

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the memory need only contain connections between the num-
ber of characters used and their corresponding symbols.

Alternatively, a user unit according to the present
invention is adapted to convert each data value into one
5   or more characters. Thus, the data values are converted
into entire words, word parts or endings. A matrix which
is made up in this manner will, of course, be more com-
pact than if each character has its own data value. A
drawback is, however, that a larger memory is necessary
10   in the user unit. Besides, that part of the matrix which
need be recorded for a word to be defined must be larger
than if each character has its own data value.

Of course, the user unit is adapted to convert the
coding pattern in dependence on how it is created.
15   Thus the coding pattern is converted in reverse
order to how it has been stored.

The conversion of the subsequences with symbols into
data values is preferably made by converting the symbols
into values, converting the subsequences with values into
20   sequence values, calculating the differences between the
sequence values and converting the differences into data
values.

The user unit is advantageously adapted to use part
of the difference between the sequence values for deter-
25   mining the relative positions of the subsequences. Since
more than one image is recorded in the inputting of a
matrix, there is a risk that certain parts of the matrix
are recorded in more than one image. By the user unit
using part of the difference to determine the relative
30   positions of the sequence parts, it is possible to ex-
clude such information as corresponds to sequence parts
that have already been recorded.

Since the conversion between data and data values is
carried out by means of a predetermined relationship, the
35   user unit must have information about how the data was
converted into data values when the matrix was formed.

A memory medium according to the invention can be
read by a computer and has a program stored thereon. The
memory medium is characterised in that the program makes
a computer record an input signal corresponding to an
5   image, and, in response to the fact that the image com-
prises a predetermined number of subsequences with sym-
bols, each of the subsequences unambiguously correspond-
ing to a position in a predetermined sequence which is
arranged in such manner that an arbitrary subsequence of
10 a predetermined magnitude unambiguously defines a posi-
tion in the sequence, convert the predetermined number of
subsequences into data.

Such a program can be executed in an arbitrary com-
puter but is advantageously executed in a reading pen
15 which comprises the necessary hardware for recording
images.

If the coding pattern is printed by a carbon-based
black ink absorbing infrared light and the printed text
is printed with an ink which is not carbon-based and does
20 not absorb infrared, the coding pattern may be sensed by
an infrared sensor, without interference by the printed
text.

The above features can, of course, be combined in
the same embodiment.

25   With a view to further elucidating the invention,
detailed embodiments thereof will be described below,
without the invention however being considered to be
restricted thereto.

The accompanying drawings are only schematic and,
30 thus, certain dimensions are greatly exaggerated so as
to illustrate the invention more distinctly.

Brief Description of the Drawings

Fig. 1 shows a document in the form of a page in
a book with a coding pattern according to a preferred
35 embodiment of the present invention.

Fig. 2 illustrates in more detail the coding pattern
in Fig. 1.

Fig. 3 illustrates a sequence which can be used to code data according to the present invention.

Fig. 4 shows an embodiment of symbols which can be used in the coding pattern in Figs 1 and 2.

5 Fig. 5 shows how part of the coding pattern is converted into characters.

Fig. 6 shows a user unit according to a preferred embodiment of the invention.

Fig. 7 shows the conversion of a matrix into data

10 values and a position value.

Fig. 8 shows the conversion of the coding pattern into sequence values.

Fig. 9 shows how part of an alternative embodiment of a coding pattern is converted into data values.

15 Detailed Description of the Invention

Fig. 1 shows a document 1 with a coding pattern according to a preferred embodiment of the present invention. The coding pattern consists of a matrix whose outer boundary 2 is marked with the frame 2.

20 Fig. 2 shows in more detail the coding pattern 2. The matrix comprises a plurality of symbols 3 arranged in sequence portions 4 in columns in the matrix, each symbol 3 defining the value "0", "1", "2", or "3". Each column with symbols is a sequence portion of a sequence with 512

25 symbols. An arbitrary subsequence, which consists of five symbols, defines unambiguously the position of the subsequence in the sequence. The sequences in the different columns are displaced in relation to each other. Fig. 1 also shows a marking 31 which indicates in which direc-

30 tion the matrix is to be recorded for the string of characters to be recorded. In Fig. 2, all symbols are marked with identical symbols. However, the symbols are of course different dependent on which value they represent.

35 Fig. 3 illustrates the appearance of a sequence 32 which is used in the invention. The sequence 32 comprises 512 values 33, each of which is either "0", "1", "2", or

"3". An arbitrary subsequence 34, 35 with 5 values defines
unambiguously a sequence value which corresponds to the
position of the subsequence in the sequence 32. Each sub-
sequence appears only once in the sequence. Thus, the
5   first subsequence 34 corresponds to the value "0" and
the second subsequence 35 to the value "1". In Fig. 2,
the columns consist of sequence portions of such sequences
in which the values have been converted into symbols.
Sequences of this kind are described in "Pseudo-Random
10   Sequences and Arrays" by F. Jessie MacWilliams and Neil
J. A. Sloane in "Proceedings of the IEEE Vol. 64, No. 12,
December 1976".

Figs 4a-d show an embodiment of a symbol which can be
used in the matrix in Fig. 1 according to the invention.
15   The symbol comprises a virtual raster point 28 which is
represented by the intersection between the raster lines,
and a marking 29 which is in the form of a point. The
value of the symbol depends on where the marking is
located. In the Example in Fig. 4, there are four pos-
20   sible locations, one on each of the raster lines extend-
ing from the raster points. The displacement from the
raster points is the same for all values. The symbol has
in Fig. 4a the value "0", in Fig. 4b the value "1", in
Fig. 4c the value "2" and in Fig. 4d the value "3". In
25   other words, there are four different types of symbols.
Each symbol can thus represent four values "0-3".

Fig. 5 shows a part 5a of the matrix 2 in Fig. 1 in
greater detail. The submatrix 5 contains five subse-
quences 36 arranged in columns in the submatrix. Fig. 5a
30   also shows the virtual raster 37 in relation to which the
symbols are arranged. Fig. 5 b shows the matrix when the
symbols have been converted into values.

Fig. 6 shows a user unit according to a preferred
embodiment of the present invention. The user unit is a
35   reading pen 14 which is arranged for recording a coding
pattern as shown in Fig. 2. The reading pen is intended
to be held by the user's hand to record images from a

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base. The reading pen comprises a light-emitting diode 7
for illuminating the surface which is to be recorded, an
image sensor 8 in the form of a CCD for recording of
images, an image processing means 9 and a memory 10. In
5   front of the CCD there is arranged a lens system 38 which
is intended for imaging of the coding pattern on the CCD.
The reading pen 14 further comprises a battery 12 for
power supply and buttons 13 by means of which the reading
pen is switched on. The reading pen is provided with a
10 transmitter 16 for transmitting recorded information to
a computer 15, which in turn is provided with a receiver
17 for receiving information from the reading pen. The
transmitter and the receiver communicate, for example, by
IR or by radiowaves. The information recorded by means of
15 the reading pen can, consequently, easily be transmitted
to the computer for further processing. The reading pen
is also provided with a display 21 for presentation of
the information recorded by means of the reading pen 14.
The reading pen 14 is also provided with a loudspeaker 55
20 to transmit sound corresponding to the data.

With reference to Figs 2, 5 and 6, the recording of
a coding pattern will now be described. When the reading
pen is passed across the matrix 2 with symbols 3, an area
is recorded, which at least comprises a first area 5 com-
25 prising a submatrix of the size five times five symbols
3. The symbols are one of the four different symbols
shown in Fig. 4. The image processing means 9 converts
the recorded image into a matrix with five times five
symbols. Then the reading pen converts the subsequences
30 36 in the matrix into subsequences 39 with values 40.
Each subsequence with values correspond to a sequence
value 27 which corresponds to the position in a sequence
with 512 values, each of which is either "0", "1", "2" or
"3". If an image is recorded which is displaced one row
35 in the matrix, sequence values are obtained, which corre-
spond to the next position in the sequence. The user unit
converts the subsequences 39 into sequence values 27.

Then the user unit calculates data values 26 as the dif-
ference modulo 1024 between the sequence values 27 for
adjoining columns. By the sequence values 27 increasing
to the same extent for each column if the recorded image
5   is displaced in the direction of the column, the data
values, which equal the difference between the sequence
values 27, are independent of the height at which the
image is recorded. The data values are then converted
into binary form and the eight least significant bits in
10 each data value are converted into characters 6 which are
stored in the memory 10, while the two most significant
bits from four adjoining data values are converted into
a position sequence part. Thus it is possible to code a
total of 256 different characters. The position sequence
15 part constitutes part of a position sequence similar to
the sequence in Fig. 3 and defines unambiguously a posi-
tion in the position sequence and constitutes a position
value for the columns.

In Fig. 5, the characters 6 are characters in a text.
20 However, it is preferred for the characters 6 to be char-
acters in a compressed text so that the string of charac-
ters which consists of the characters 6 need be converted
so as to obtain text en clair.

The position values for the columns are used to
25 determine whether a character from a subsequently record-
ed image has already been stored in the string of charac-
ters in the memory. This is usable since the next image
which is recorded comprises, for example, a second area
22 which comprises parts of the first area 5. When the
30 subsequences in the second area 22 are converted into
characters, the characters will partly be the same as
those recorded when the first area 5 was recorded. By the
position value being given by the difference values, the
previously stored characters can be dropped. A coding
35 pattern codes, for example, the series [(0, 12), (1, 25),
(2, 37), (3, 82), (4, 24), (5, 16)] in which the first
value in each pair of values corresponds to a position

value and the second value corresponds to a data value.
In a first image, the series [(0, 12), (1, 25), (2, 37),
(3, 82)] is recorded. In a second image, the series [(2,
37), (3, 82) (4, 24), (5, 16)] is recorded. Thus, the
5   values "37" and "82" are recorded twice. The position
values indicate, however, that they have been recorded
even the first time, which makes it possible to produce
the correct series once more.

     A further example of when the positions of the subse-
10 quences are important is when the reading pen is quickly
passed across the coding pattern. Then there is a risk
that some information is not recorded. By having a posi-
tion code in subsequences, it will be possible to pass
the reading pen across the coding pattern once more,
15 thereby recording the information that was not recorded
the first time. This is illustrated in Fig. 7. Fig. 7
shows a small part 43 of a coding pattern in the form
of a plurality of symbols 42 arranged in columns 45 in
a matrix. It is thus sufficient to record a subsequence
20 consisting of five symbols of each column 45. When the
reading pen is passed across the coding pattern, several
images are recorded. A first image 39 and a second image
40, which are recorded by the reading pen, are separated.
Since some of the symbols in the pattern have not been
25 recorded in an image, some information is missing. It is
then possible to pass the reading pen across the coding
pattern a second time to record a third image 46 which
contains information from the columns that were missing
in the first image 39 and in the second image 40. By the
30 subsequences containing position information, it is pos-
sible to enter the information from the third image 46 in
the correct position in relation to the information from
the first image 39 and second image 40. A coding pattern
codes, for example, the series [(0, 12), (1, 25), (2,
35 37), (3, 82) (4, 24), (5, 16)], where the first value in
each pair of values indicates the position value and the
second value indicates the data value. In a first record-

ing, the series [(0, 12), (1, 25), (2, 37), (4, 24), (5,
16)] is recorded. In a second recording, the series [(0,
12), (1, 25), (2, 37), (3, 82) (4, 24)] is recorded.
Since the data value "82" which corresponds to the
5   position value "3" is included in the second series, the
complete series can be produced.

According to a preferred embodiment, each difference
value codes only part of a position value. This is illus-
trated in Fig. 7. The matrix 53 with symbols 54 is con-
10 verted into sequence values S_1-S_5 in the same manner as
described above. The difference between the sequence
values forms a set of data values D_1-D_4 and a set of sub-
position values P_1-P_4 which together form a sequence de-
fining a position value which indicates the position of
15 the matrix in the coding pattern.

Fig. 8 also illustrates how the information from
images, which have been recorded at different heights
in the matrix, is processed. The first image 40 contains
five times five symbols. The symbols are converted into
20 values as described in connection with Fig. 5. The values
in the columns are then converted into sequence values
which correspond to the position of the subsequence in
the sequence. The five subsequences with symbols which
correspond to the columns in the first image 40 are thus
25 converted into a first set of five sequence values 47.
The first set of five sequence values 47 is then convert-
ed into a first set of difference values 48, which in
turn are converted into characters in the same way as
described in connection with Fig. 5. When a third image
30 41 containing five times five symbols is recorded, the
five subsequences consisting of five symbols are convert-
ed into a second set of five sequence values 49. The
second set of five sequence values 49 is then converted
into a second set of difference values 50 which in turn
35 are converted into characters in the same way as describ-
ed in connection with Fig. 5. Each of the sequence values
49 in the second set is four units greater than the

sequence values 47 in the first set since they are fetch-
ed further down in the sequences of which the sequence
parts consist a part. However, each of the difference
values 48 in the first set of difference values is equal

5   to the corresponding difference value in the second set
of difference values. Thus, the difference values are
independent of at what height in the matrix 43 the images
have been recorded.

When producing the matrix in Fig. 5, each character

10   6 in a string of characters is first converted into data
values by means of a reference table which is stored in
the memory. The data values consist of eight bits. Dif-
ference values 26 are then produced by adding position
information in the form of two binary bits to the data

15   values. The position information 30 is selected in such
manner that four successive difference values 26, 48, 50
give a position subsequence which unambiguously defines
a position value which gives a position subsequence
which unambiguously determines a position in a position

20   sequence. Parts of identical sequences are then arranged
in columns in the matrix. The identical sequences are
such that a subsequence with five successive values from
the sequence unambiguously determines a sequence value 27
which corresponds to the position of the subsequence in

25   the sequence. The parts of the sequences are arranged
in such manner that the set of differences between the
sequence values for the sequence parts, which have been
taken from the same rows in the matrix, corresponds to
the difference values 27. Subsequently the values 40 in

30   the sequences are converted into symbols 3.

In fig 9 another embodiment of a coding pattern is
shown in which the entire coding pattern has a height 64
corresponding to the length of a subsequence, i.e. five
symbols 60 in this case. The coding pattern is of a

35   similar type as described in connection with fig. 5, i.e.
the value of a symbol depends on the position of a mar-
king 60 in relation to a virtual raster with raster lines

65. The distance 61 between different raster lines 65 is
0.3 mm in this embodiment. With this distance between the
raster points the coding pattern becomes considerably
robust while at the same time being compact. The symbols
5   in the square 66 are converted into subsequences 62 as
described in connection with fig 5. The subsequences are
in turn converted into sequence values 63. According to
this embodiment each sequence value correspond to a
character and a position code. The sequence value "96"
10 corresponds for example to the character " " (space) and
the position code "17". According to this embodiment of
the invention the reading pen thus has to record all
symbols in the height of the coding pattern in order to
be able to convert into text. An advantage of this
15 embodiment is that each character may be recorded by
recording only one column of symbols.

        In a preferred embodiment, 6*6 symbols are used for
coding the pattern. A more detailed explanation of how
the coding is done appears from Applicant's PCT patent
20 applications Nos. WO 00/73983, PCT/SE00/1667 and WO
01/16691, the contents of which are included in the
present specification by reference.

        The above embodiments are to be considered examples
only.
25   A person skilled in the art realises that the above
embodiments can be varied in a number of ways without
departing from the inventive idea. For example, it is not
necessary that the user unit be a single integrated unit.

        It is not necessary for the invention that a display
30 be arranged directly on the user unit.

        Although the examples above only illustrate that the
sequence portions are arranged in columns in a matrix,
this is not necessary for the invention. The sequence
portions can be arranged in an arbitrary manner.

35   It goes without saying that the sequences that are
used to code the data need not be 512 character long.

Of course any number of symbols may be used to code a value.

CLAIMS

1. A method for storage of non-sequential data,
5   c h a r a c t e r i s e d   in that it comprises the steps
of
       coding the non-sequential data (6, 52) to a coding
pattern (2) by means of at least one sequence (32) with
symbols which have the characteristic that an arbitrary
10   subsequence (34, 35) of a predetermined magnitude of the
sequence unambiguously defines the position of the
subsequence (34, 35) in the sequence (32), and
       reproducing the coding pattern (2) on a product.
       2. A method as claimed in claim 1, c h a r a c -
15   t e r i s e d   in that it also comprises the step of con-
verting the data (6, 52) into a set of data values (26),
the pattern being arranged so as to comprise sequence
portions of said at least one sequence in a coding pat-
tern, said sequence portions being at least of the same
20   magnitude as the subsequences of a predetermined magni-
tude, so that each of the data values is coded by a group
each of at least two sequence portions (4) in the coding
pattern.
       3. A method as claimed in claim 1, c h a r a c -
25   t e r i s e d   in that it also comprises the step of con-
verting the data (6, 52) into a set of data values (26),
the pattern being arranged so as to comprise sequence
portions of said at least one sequence in a coding pat-
tern, said sequence portions being of the same magnitude
30   as the subsequence of a predetermined magnitude, so that
each of the data values is coded by one sequence portion
(4) in the coding pattern.
       4. A method as claimed in claim 2, c h a r a c -
t e r i s e d   in
35   that the data (6, 52) is coded with only one se-
quence (32),

that the position of a subsequence in the sequences
constitutes a sequence value (27) and

that the relationship between the sequence values
(27) from different sequence portions (4) defines the
5   data values.

5. A method as claimed in claim 2 or 4, c h a r -
a c t e r i s e d   in that each of the data values is
defined by the difference between the sequence values
(27) for two subsequences (39) from different sequence
10   portions.

6. A method as claimed in claim 5, c h a r a c -
t e r i s e d   in that the sequence portions (4) are
juxtaposed in a matrix (2) in such manner that each of
the data values is defined by the difference between the
15   sequence values (27) of two adjoining subsequences from
corresponding parts of the sequence portions in the
matrix (2).

7. A method as claimed in any one of claims 2-6,
c h a r a c t e r i s e d   in that the sequence portions
20   also code at least part (30) of a position value which
defines the serial number of the sequence portion.

8. A method as claimed in any one of the preceding
claims, c h a r a c t e r i s e d   in that the data is
characters, and that the characters are converted into
25   data values.

9. A product on which non-sequential data (6, 52) in
the form of a coding pattern (2) is stored, which codes
the data (6, 52) c h a r a c t e r i s e d   in that the
coding pattern (2) consists of sequence portions (4) with
30   symbols (3) which each comprise at least a subsequence of
a sequence which is arranged so that an arbitrary
subsequence of a predetermined magnitude of the sequence
unambiguously defines the position of the subsequence in
the sequence.

35   10. A product as claimed in claim 9, c h a r a c -
t e r i s e d   in that the coding pattern codes a set of
data values, each of the data values coding a group each

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of sequence portions (4) consisting of at least two se-
quence portions.

11. A product as claimed in claim 9 or 10,
c h a r a c t e r i s e d   in that the symbols (3, 24)
consist of markings, the size of the markings defining
the value of the symbol.

12. A product as claimed in claim 9 or 10,
c h a r a c t e r i s e d   in that each of the symbols (3,
24) comprises a raster point (28) and a marking (29), the
value of each symbol being indicated by the position of
said marking (29) in relation to the raster point (28).

13. A product as claimed in any one of claims 9, 10,
11 or 12, c h a r a c t e r i s e d   in that the product
(1) is a sheet of paper.

14. A product as claimed in any one of claims 9-13,
c h a r a c t e r i s e d   in that the coding pattern (2)
codes text.

15. A product as claimed in any one of claims 9-13,
c h a r a c t e r i s e d   in that the coding pattern (2)
codes a command.

16. A user unit for optical recording of informa-
tion, which comprises an image sensor (8) and which user
unit (11) is adapted to optically record images from a
surface by means of the image sensor (8), c h a r a c -
t e r i s e d   in that it is adapted, in response to the
fact that a recorded image comprises a predetermined num-
ber of subsequences with symbols, each of the subse-
quences unambiguously corresponding to a position in a
predetermined sequence which is arranged in such manner
that an arbitrary subsequence of a predetermined magni-
tude unambiguously defines a position in the sequence,
to convert the predetermined number of subsequences into
non-sequential data (6, 52).

17. A user unit as claimed in claim 16, c h a r -
a c t e r i s e d   in that it also comprises a display,
and that it is adapted to show data on the display.

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18. A user unit as claimed in claim 16, c h a r -
a c t e r i s e d in that it further comprises a loud-
speaker, and that it is adapted to transmit, by means of
the loudspeaker, sound corresponding to the data value.

5   19. A user unit as claimed in any one of claims
16-18, c h a r a c t e r i s e d in that it is adapt-
ed to convert the symbols (3, 24) into subsequences with
values,

             to convert the subsequences with values into
10   sequence values (27),

             to calculate difference values (26) as the differ-
ence between the sequence values (27),

             to convert the difference values (26) into data
values, and

15   to convert the data values into data (6, 52).

             20. A user unit as claimed in claim 19, c h a r -
a c t e r i s e d in that some of the difference values
(26) are used to determine the relative positions of the
subsequences.

20   21. A user unit as claimed in claim 20, c h a r -
a c t e r i s e d in that it is adapted to use the rela-
tive position of the subsequences to decide whether data
(6, 52) corresponding to a data value has been previously
recorded.

25   22. Use of a coding pattern for storage of text,
said coding pattern (2) consisting of sequence portions
(4) with symbols (3) which each comprise at least a sub-
sequence of a sequence which is arranged in such manner
that an arbitrary subsequence of a predetermined magni-
30   tude of the sequence unambiguously defines the position
of the subsequence in the sequence.

             23. A computer-readable memory medium, on which a
program is stored, c h a r a c t e r i s e d in that
the program makes a computer (14)

35   record an input signal corresponding to an image,
and

in response to the fact that the image comprises
a predetermined number of subsequences with symbols (3,
24), each of the subsequences unambiguously correspond-
ing to a position in a predetermined sequence (32) which

5   is arranged in such manner that an arbitrary subsequence
(34, 35) of a predetermined magnitude unambiguously
defines a position in the sequence (32), convert the pre-
determined number of subsequences into non-sequential
data.

10   24. A storage medium as claimed in claim 23,
c h a r a c t e r i s e d   in that the program makes the
computer output a signal to a display unit for presenta-
tion of the data.
       25. A method for storage of non-sequential data,

15   c h a r a c t e r i s e d   in that it comprises the steps
of
       converting the data (6, 52) into a set of data
values (26),
       coding the data values (26) to a coding pattern (2)

20   by means of at least one sequence (32) with symbols which
have the characteristic that an arbitrary subsequence
(34, 35) of a predetermined magnitude of the sequence
unambiguously defines the position of the subsequence
(34, 35) in the sequence (32), the pattern being arranged

25   so as to comprise sequence portions of said at least one
sequence in a coding pattern, said sequence portions
being at least of the same magnitude as the subsequences
of a predetermined magnitude, wherein the sequence
portions also code at least part (30) of a position value

30   which defines a serial number of the sequence portion,
and
       reproducing the coding pattern (2) on a product.
       26. A method for storage of data, c h a r a c -
t e r i s e d   in that it comprises the steps of

35   coding the data (6, 52) to a coding pattern (2) by
means of at least.one sequence (32) with symbols which
have the characteristic that an arbitrary subsequence

24

(34, 35) of a predetermined magnitude of the sequence
unambiguously defines the position of the subsequence
(34, 35) in the sequence (32), and

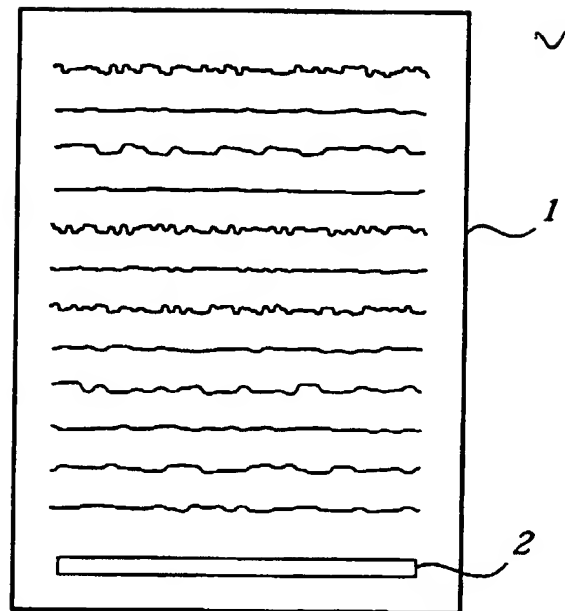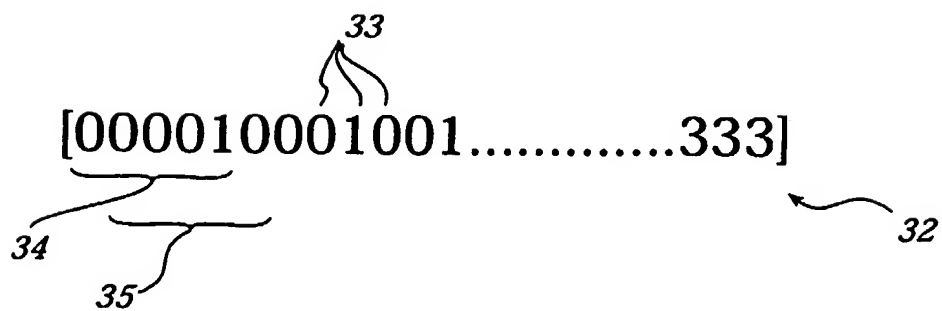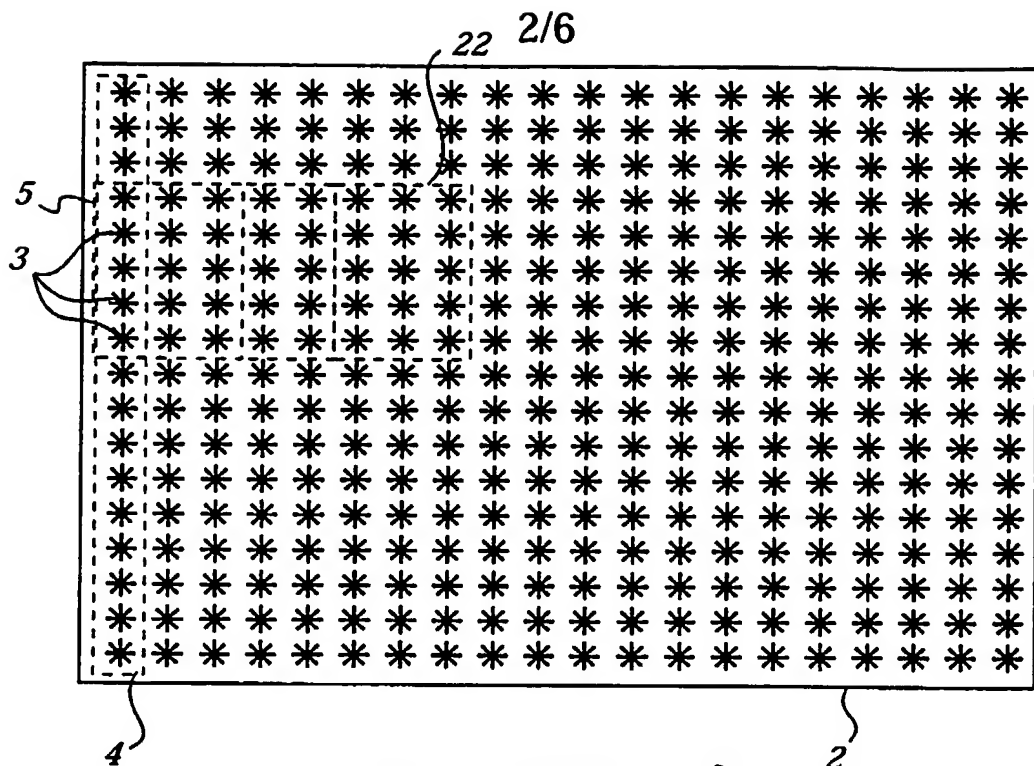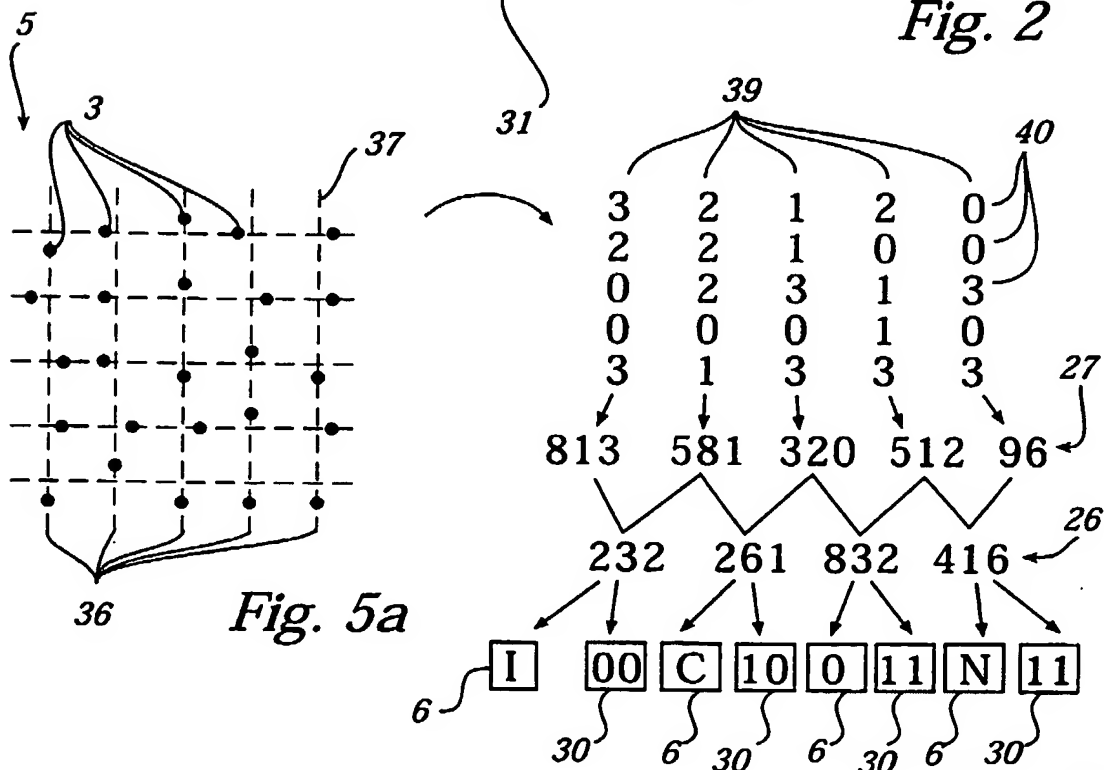reproducing the coding pattern (2) on a product.

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Fig. 1

Fig. 3

Fig. 2

Fig. 5a
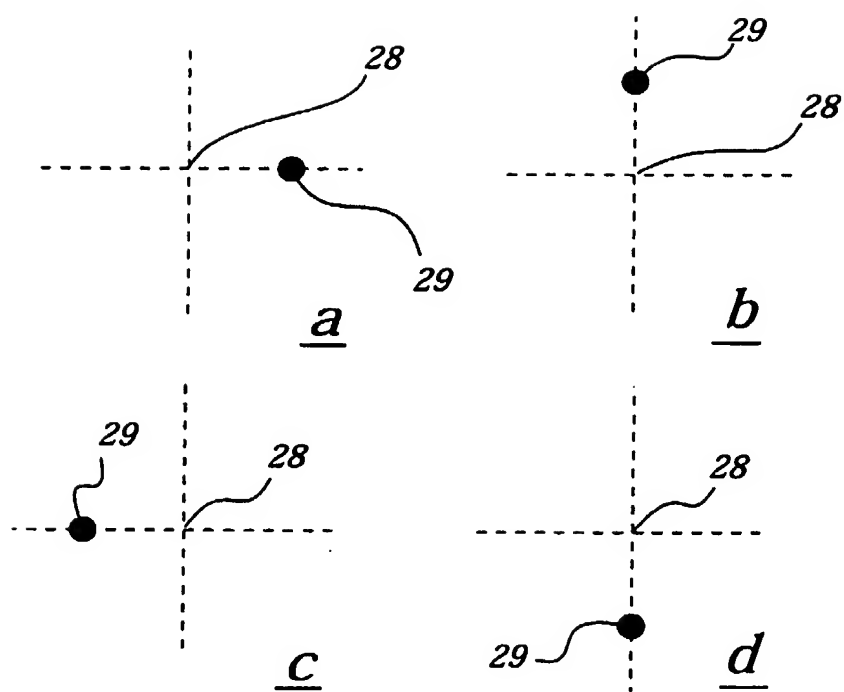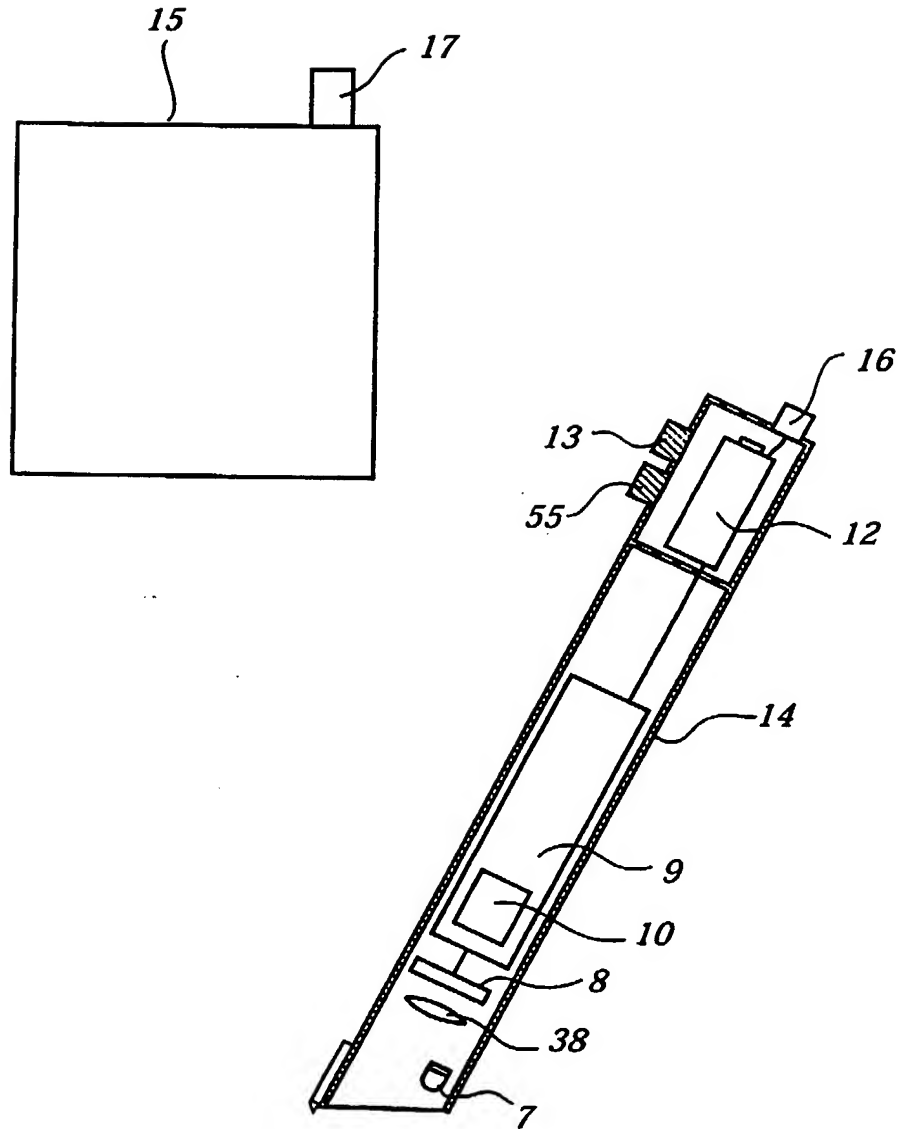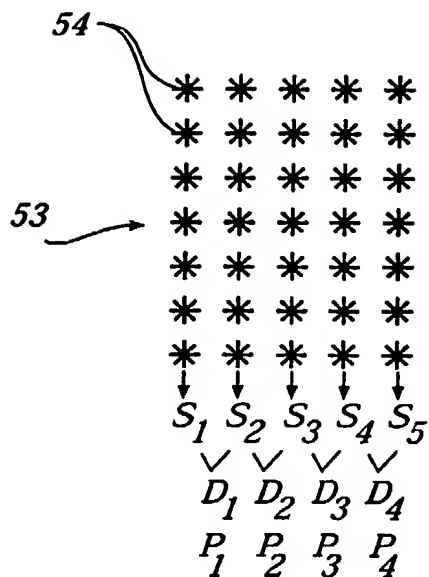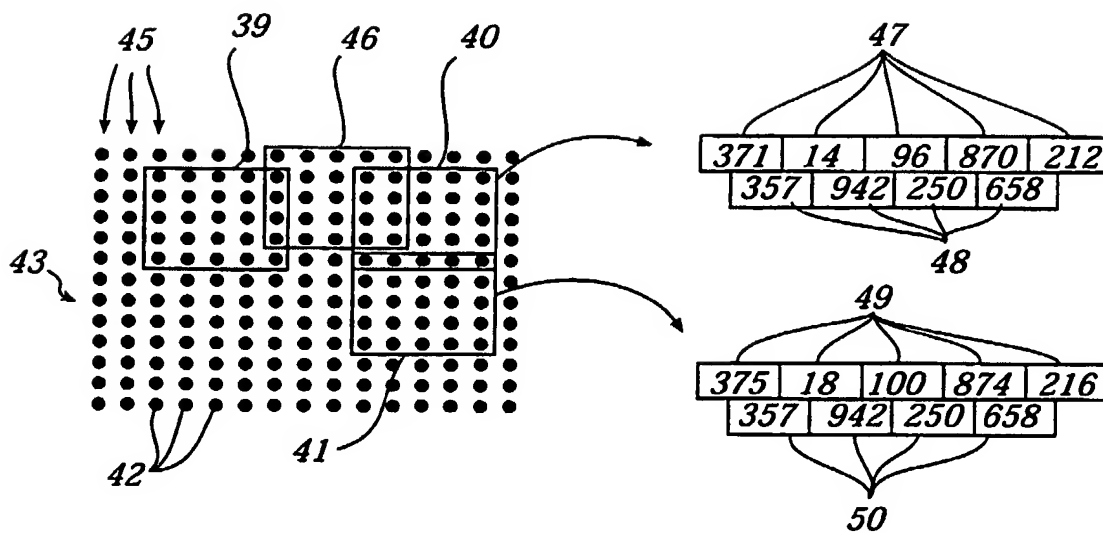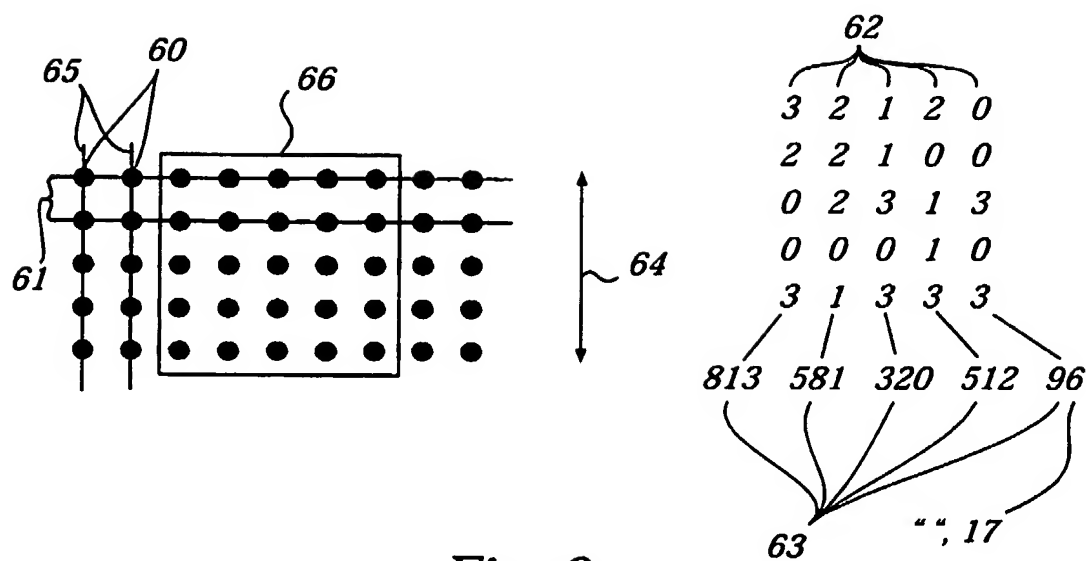
Fig. 5b

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Fig. 4

Fig. 6

54

53

$$S_1 \quad S_2 \quad S_3 \quad S_4 \quad S_5$$

$$D_1 \quad D_2 \quad D_3 \quad D_4$$

$$P_1 \quad P_2 \quad P_3 \quad P_4$$

Fig. 7

45 39 46 40

43

42 41

47

371	14	96	870	212

357	942	250	658

48

49

375	18	100	874	216

357	942	250	658

50

Fig. 8

Fig. 9

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INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06K 11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9217859 A1 (HEWLETT PACKARD COMPANY), 15 October 1992 (15.10.92), figure 1, abstract	1,9,13,26
A		2-8,10-12, 14-25
	--	
A	US 5661506 A (M.LAZZOUNI ET AL.), 26 August 1997 (26.08.97), abstract	1-26
	--	

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

Date of the actual completion of the international search	Date of mailing of the international search report
18 June 2001	0 3 -07- 2001
Name and mailing address of the ISA/ **Swedish Patent Office** Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Oskar Pihlgren/LR Telephone No. + 46 8 782 25 00

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Patent document cited in search report			Publication date	Patent family member(s)			Publication date
WO	9217859	A1	15/10/92	DE	69202975	D,T	15/02/96
				EP	0578692	A,B	19/01/94
				GB	9106990	D	00/00/00
				GB	9120982	D	00/00/00
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				US	5442147	A	15/08/95
US	5661506	A	26/08/97	NONE			